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Surface **Transportation** for the Year 2020

A Desirable Scenario



U.S. Department of Transportation
Federal Highway Administration

Introduction

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The greatest risk we run when using our imagination as a springboard into the future is that our descendants will one day come across our speculations and have a good laugh at our expense. Nonetheless, we know imagination alone won't "make it so," but speculation on how things might be 20 or 25 years down the line can bring us closer to our destination by carving out signposts to point the way.

This paper was developed through a team effort that involved the Federal Highway Administration's (FHWA's) Office of Safety and System Application, the Office of Public Affairs, and the Region 10 Office. The views expressed in this paper do not represent the official policies or positions of the FHWA or the U.S. Department of Transportation. Instead, this paper is intended to stimulate and provoke thinking about both the future of our agency and the future of this country.

September 1995

Surface Transportation is a Sound Investment

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This paper focuses on the most "desirable" future for the Nation's surface transportation system and the role of the FHWA in shaping that future in the year 2020. A desirable future is one that fosters personal mobility and access with a reduced need for travel. It also is one that actively promotes safety, economic growth, and enhanced productivity, while fostering significant and ongoing reductions in environmental impact. A desirable future also includes stronger public/private partnerships and creative new ways using both public and private sector funding sources to finance improvements to the surface transportation system. Finally, a desirable future includes a streamlined and innovative successor to the FHWA, a surface transportation agency focused on safety and operations that is proactive in responding to the needs of its employees and customers.

The desirable scenario to follow describes the life of a "typical" American family of the future. We chose this approach as a means to address the social, economic, and other issues of the future in the context of the role that transportation plays in day-to-day family life. Our format choice underscores the increased importance of the general public as a primary "customer." The scenario attempts to portray the most desirable future in an optimistic light, without making unrealistic assumptions that could bias the issues and alternatives presented.

Background

The year is 2020 and the place is Metropolitanville, a suburb of a large urbanized area that stretches from New York to Virginia. The Johnson household includes a husband and wife, a teenage son, and a 10-year-old daughter. This is the second marriage for both, and Mr. Johnson's adult son from his first marriage lives in Missouri. Ms. Johnson's aging parents live several hundred miles away and are beginning to have health problems that could affect their mobility and access to needed services.

Under the desirable scenario, America is enjoying a period of real economic strength. This trend began early in the century as the reengineering of American industry began to take hold. Companies are working more efficiently, responding faster to global market opportunities, and reinvesting assets into the development of new ideas. As such, America is a strong international competitor and partner and its citizens share in the wealth.

Because of this, citizens have been more willing to invest in the services that improve their quality of life and support continued economic growth.

Alternative Commutes and the New Workplace

At the start of a typical Monday morning, Mr. and Ms. Johnson prepare for work and the children get ready for school. Both parents telecommute most days, using their home computers to communicate with clients and coworkers. They still must go to the office for an occasional meeting and other essential face-to-face communications that cannot be handled through teleconferencing via their home video-phone.

During the first quarter of the 21st century, most service-oriented firms have discovered that working at home improves employee productivity while fostering greater client access. This access is particularly important for international trade, and Mr. Johnson frequently must communicate with overseas suppliers and partners during their business hours. Business overhead also has been greatly reduced through diminished need for office space and related equipment. An important environmental benefit of telecommuting is reduced peak-period travel demand, which has decreased pollution levels. Additionally, rural areas enjoy increased growth and prosperity as workers are no longer tied to their urban/suburban workplaces.

Ms. Johnson remembers that by 2005, telecommuting and other alternative work schedules were prevalent and employees were only in the office on certain hours and days. Traffic was noticeably lighter on Mondays and Fridays, the most frequent telecommuting days.

Telecommuting program will need to gain brand-based employer acceptance before impact on traffic congestion will be noticeable. Alternative work schedules could dissipate peak commuting times, thereby reducing congestion. The downside, however, is that staggered work schedules reduce the likelihood of carpooling. Public transportation schedules also would need to be adjusted, but smaller, more fuel-efficient vehicles could be used.

Getting to Work or School

This Monday morning, Mr. Johnson will drive to work because he has an important meeting at the office with two of his international partners. Before leaving home, Mr. Johnson checks the cable-TV traffic channel for travel times and congestion levels along his route. Real-time, multimodal traveler information has been readily available throughout the Metropolitanville region for the past 15 years and has proven invaluable for both commuting and long-distance travel.

While the amount of traffic has leveled off in recent years—despite the area’s growing population—he often decides it’s faster to take the bus than to drive. Buses use the express lanes to downtown and using his regular banking “smart card” to pay fares and transfers has made using public transit easier and more convenient for him. The cost also is competitive. New technologies have replaced the old, inefficient fuel tax collection system on gas and diesel with an automatic billing system that charges drivers based on weight/distance, factoring in peak period use. There are also electronic toll collection systems on local expressways. Tolls are higher during peak periods, and toll and charge revenues

help finance improved traffic surveillance, freeway management activities, and infrastructure improvements.

Mr. Johnson’s commute to downtown is actually to an “edge” city that has evolved as a business and commercial center. Ten years ago this area had housed only a few corporate offices and a shopping mall. Now, however, it is the place where many spend both their working and leisure hours.

Timely and accurate multimodal transportation information must be available as a means of influencing travel decisions. Local decision makers—and the general public—may not accept “congestion pricing” as a means of financing transportation improvements and/or modifying travel behavior. Unless the need to travel is reduced, increasing costs for transportation may have negative impacts on business and on the economically disadvantaged.

More Environmentally Benign Transportation

Another reason Mr. Johnson decides to drive to his office is that he needs to run some errands on the way home. While he reluctantly admits that he prefers to drive alone, he—like most Americans—is increasingly sensitive to environmental issues. His car has an improved emissions control system, but Mr. Johnson knows that his decision to use his car will still contribute to traffic congestion and air pollution. He also knows that his “excuse” of needing to run errands is becoming less valid as home shopping, banking, and other services are increasingly convenient and available through his home computer system.

On most days, 10-year-old Susie Johnson rides to school on her ultra-light, high-tech bike wearing the required and now socially accepted safety helmet. A network of convenient interconnected bike paths and crossings protected from motorized traffic make her trip fast and safe. Technological advances have made alternative fuel vehicles and small, battery-powered cars economical and popular for local commuting and other short trips.

Despite the increase in trips by bicycle and walking, the number of adults and children injured or killed has decreased dramatically from the 1990s, especially among school age children. DOT's new safety outreach programs aimed at the schools have contributed to increased safety by teaching children safer behaviors.



The general public must be sensitive to the impacts of transportation on the environment and create a market for less polluting means of travel. The public must also be willing to invest a portion of their resources in the infrastructure to support bicycles and other alternative vehicles.

Safer Travel

The couple's teenage son, John, drives to school because his afternoon job is to deliver pizza for a local shop. While insurance rates remain steep for teenage drivers, the Johnson family gets a discount because the car the son drives has intelligent cruise control and a near-obstacle detection system that alerts him to vehicles in the car's blind spots. Under the "graduated" licensing system in place in most States, John and other teenagers are permitted to drive without an adult only during daylight hours.

Vehicle location and communication systems have been standard on new cars for the past 15 years. These "Mayday" systems not only allow drivers to call for emergency help, they also will automatically notify authorities when a crash occurs and provide the vehicle's precise location to incident response teams. These systems have long been popular with consumers and have taken on greater importance as rural and elderly populations increase.

In the mid-1990s, it was estimated that highway injuries and fatalities, together with resulting property damage, cost the Nation's economy \$ 140 billion annually. These costs have been dramatically reduced by technological advances in vehicle and roadside safety and the continuing social unacceptability of alcohol-impaired driving. Changing demographics and increasing public awareness of safety issues also has improved highway safety. A declining birth rate early in the 21st century has resulted in fewer teenage drivers. As new vehicles have penetrated the market, technology that tests a driver's sobriety before an auto's engine will start has greatly reduced driving-while-intoxicated incidents.

Based on projected consumer demand, auto manufacturers and others must be willing to invest in the development of improved safety devices and collision-avoidance systems. The infrastructure must support more advanced vehicle safety systems that rely on vehicle-to-roadside communications. A public/private partnership will be the only viable solution to pay for such and infrastructure. A national ITS system architecture and standards must also be developed to ensure interoperability and national compatibility.



Improved Management of the Transportation System

Once on the road, Mr. Johnson's in-vehicle information system provides him with dynamic route guidance based on real-time traffic conditions. Like most other urban areas in the country, Metropolitanville benefits from a fully deployed, core ITS infrastructure that supports advanced traffic, transit, and freeway management systems, as well as a regional traveler information system. Smaller, more reliable, areawide traffic detectors, coupled with more economical microcomputer technology, enable Metropolitanville and many other cities to use adaptive traffic control systems that adjust signal timing, ramp metering, and lane control based on real-time traffic flows. Dynamic traffic assignment algorithms are able to predict congestion levels in advance and adjust signal timing to alleviate the problem before it occurs. The region also has an aggressive incident management program so that a minor incident along Mr. Johnson's route to work is cleared before there are any significant delays.

The region is also part of an active Corridor Coalition that functions as a multi-State, "quasi-governmental" organization to promote interjurisdictional cooperation and facilitate regional transportation planning and dissemination of traveler and transportation management information throughout this large East Coast urban area. Forward-thinking public officials in Metropolitanville and other surrounding areas are proponents of ITS and have secured substantial State and local funds, and regular Federal-aid, to support its deployment. The communications infrastructure, along with much of the traffic surveillance, is provided by a

private sector telecommunications consortium that markets traveler information as a value-added service to its customers.

When he needs to drive to work, Mr. Johnson usually commutes via expressway. The owner of the company for which Mr. Johnson works, however, lives in a more rural area. When Mr. Johnson's boss travels to the office, her drive is on rural roads that wind, and many blind curves make driving more strenuous. The 2-lane road in front of her home offers only a few of the advanced features most drivers are accustomed to on freeways. Still, the ITS in-vehicle technology and the rural Advanced Traveler Information Systems have improved the safety of rural travel. In recent years, the number of run-off-the-road, single-vehicle crashes on rural lanes has decreased dramatically because ITS advances have curtailed excessive speed and driving while intoxicated-two factors once common in rural accidents. Ultraviolet pavement markings have also contributed to a decline in run-off-the-road accidents at night.

The first automated highway system has been operating for several years; it carries buses at close leadways through a tunnel in New York City. The automated highway system moves far more people more efficiently and with less environmental impact than the old tunnel system.

The private sector must perceive that a viable market exists to invest in a communications and/or surveillance infrastructure that would support commercial ITS products and services. Adequate public funding must also be available to support ITS deployment, operations, and maintenance. Public and private sector transportation professionals must have the knowledge and skills to develop and support advanced technology systems.

Technology and the Natural Environment

Mr. Johnson's commute is uneventful this morning, but that hasn't always been the case. Throughout the years, the commute from the suburbs has been filled with incidents Mr. Johnson would rather forget.

Metropolitanville is in a river valley and while beautiful, the setting has its disadvantages, especially in winter and spring. In 2005, Mr. Johnson's commute was seriously delayed by two incidents—a truck carrying hazardous materials overturned just before the bridge, and a few months later, the bridge collapsed during spring flooding. In the first incident, Mr. Johnson was delayed 6 hours when the shipping papers for the truck's cargo could not be found, and the driver had fled the scene. The second incident involved bridge scour that resulted in a collapsed bridge span, killing eight people. The advance warning system installed 5 years earlier prevented additional loss of life but couldn't help the vanpool already on the bridge. It took many months and a significant reengineering investment before commuting returned to normal.

Though lessons learned from these experiences extracted a heavy toll, significant technology and safety advances have been made. Ten years after these incidents, devices to monitor bridge scour have been installed on all area bridges over water. If scour reaches a critical level, remote satellite link-ups alert maintenance personnel and remedial measures are taken immediately. A bridge hasn't been lost since. The U.S. Department of Transportation also has improved hazardous material oversight and incident coordination.

As of the year 2006, all questions about Federal hazardous materials transportation regulations (routing, commercial driver licensing, placarding, incident management) are handled by one office that is responsible for both radioactive and nonradioactive materials and all modes of transportation (land, air, and sea). Emergency response is vastly improved.



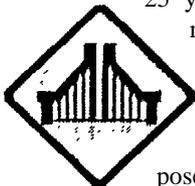
Winter commutes have had their nonicnts as well, but snow and ice removal technology—including environmentally acceptable, noncorrosive chemicals, and heated bridge decks and pavements—have significantly reduced hazardous driving conditions.

Even when natural events were not a factor, there was the constant nuisance of long commuting dclays caused by roadway and bridge repairs. Today, much has changed. New high-strength and composite materials play a key role in improving the infrastructure and minimizing situations that can result in accidents and congestion. While road maintenance and repair will never completely disappear, products such as the SUPERPAVE system, high-strength, corrosion-resistant steels, and high-performance concrete have done much to foster infrastructure durability and minimize the need for repairs.

Technology, creative use of resources, and a receptive political climate since the turn of the century have produced a National Highway System of quality. Infrastructure is much safer and much more durable. New materials and reduced truck traffic—because of more efficient use of all transportation modes—have made rough pavements and

potholes relics of the 1990s. Most bridges are now constructed without joints, which greatly improves ride quality. Additionally, nondestructive testing and evaluation techniques borrowed from the defense and aerospace industries at the turn of the century have provided means of accurately assessing conditions without affecting structural integrity. Today, laser, x-ray, and acoustic technologies are routinely used to evaluate structures. Sensors built into culverts and other vital links in the system are routinely monitored to ensure minimum disruption to service.

In addition to technological advances, bridge and pavement management systems have incorporated design, inspection, repair, and rehabilitation data collected throughout the past 25 years and integrated it with 21st century computer modelling to transform what was once considered a fine art into more of an exact science.



While not a day-to-day concern for East Coast commuter Mr. Johnson, earthquakes continue to pose serious threats to the 21st century transportation system. In fact, his older son lives near New Madrid, Missouri - the location of one of the most severe earthquakes to hit the U.S. and a site closely monitored by seismologists.

Borrowing from leads taken in the building industry and advances in geotechnical and foundation engineering, transportation structures are now designed and constructed to minimize failure during earthquakes. In the event that failures occur, they now do so in ways that mitigate catastrophic effects.

Today's technological breakthroughs--new materials and space age technologies--will be needed for infrastructure of the future. Transportation agencies must be willing to pay the extra up-front costs for longer lasting, more durable transportation systems.



Access and Mobility

The post-World War II baby boomers are now in their seventies and eighties. Advancements in medicine and health care have allowed most to enjoy unprecedented good health. Vision-enhancement systems, available as an option in most new cars, improve visibility for elderly and other drivers at night and during poor weather conditions. Signing has also improved. Retroreflectivity standards allow drivers of all ages to see traffic control devices at nighttime, and signs are easier to see in the daytime, too, because vivid, fluorescent background colors, such as strong yellow green, are now used. Also, many of these active older Americans have foregone the rigors of suburban commuting to live in revitalized center city areas with convenient entertainment and services. Everyone carries a personal communications device that provides readily available information, while affording a greater sense of security.

The appeal of the center city has changed considerably in recent years, not only for people like Ms. Johnson's parents, but also for a diverse cross section of the American population. Economic growth, more opportunities to partner with industry for jobs, a strong focus on making the community safe and free of crime, and enhanced educational opportunities through technological advances have made the

center city a more attractive place to live for citizens across the social and economic spectrum.

Ms. Johnson's parents, who are now in their nineties, rarely drive. They rely heavily on their city's personalized public transit system, which provides them with door-to-door transportation to services they cannot access through their home computer. When Ms. Johnson's parents call the transit center to request a ride, new computer and information technologies make reservations, assign vehicles, and schedule transportation in real-time. A computer assigns the closest vehicle to pick them up and advises them of the expected arrival time. The increased flexibility and convenience of transit service have made it more appealing not only for the elderly, but also for others without access to an automobile.

The Johnson family also finds that its thinking about modal choices has changed over the years. By the early part of the 21st century, the Nation's airports had become so congested that Americans demanded better service. In a program, likened to the construction of the Interstate, new airports were built around the country to serve the mid- and long-range travel needs of the population. Families like the Johnsons now routinely use air travel to reach vacation destinations and find that renting a vehicle there is more economical than making the trip in the family car.



Technological advances are needed to make personalized public transit economically viable and accepted by consumers. Investment is needed in other modes to make them viable and attractive alternatives to automobile travel.

Commercial Vehicle Operations

Ms. Johnson is president of a firm that assembles home computers using parts manufactured worldwide. To maintain minimum inventory, the firm relies on just-in-time delivery of needed parts. Advanced technologies make this possible by providing information links among drivers, dispatchers, and intermodal transportation providers. All trucks now carry standardized, intermodal containers that offer full compatibility among highway, rail, air, or sea transport of goods. New truck configurations have also reduced pavement wear. Transponders on the containers provide information about contents, routing, and destination of the load, which allows easy intermodal transfers. Through new technologies, including satellite tracking and communications systems, fleet managers have access to real-time data on the location of both their vehicles and their cargo.

Dramatic changes in the entire commercial vehicle industry in the past 25 years have been accompanied by substantially increased productivity and safety. Most vehicles are equipped with transponders that allow enforcement personnel to electronically check the vehicle's safety, credentials, and size and weight data-without stopping for roadside inspections. Since 2000, an electronic licensing system has allowed motor carriers to purchase credentials and report fuel and mileage tax information electronically. It also has considerably reduced the paperwork and alleviated the administrative burden for both the States and the motor carriers. Many commercial vehicles also have on-board safety systems that monitor the driver, the vehicle, and the cargo, and notify the driver and the carrier of unsafe conditions.


Institutional and other barriers to commercial vehicle electronic clearance must be removed without compromising the privacy and security of commercial carriers and drivers, while maintaining the economic interests of the States. Commercial carriers and drivers must perceive the economic and safety benefits of advanced technologies if they are to invest in their use.

Implications to the FHWA

Although families like the Johnsons will be affected by changes in transportation in the next 25 years, so too will the FHWA family. It is worth considering that, in 2020, the majority of Federal employees will not have been hired as of 1995. They will have very little experience in the design and construction of the Interstate System and will have been hired in an era of a shrinking Federal Government. They will have a very different sense of loyalties and ties to their employer. Much is likely to change between now and then—our customer base, our programs, our organization, and our staffing. Some possibilities follow.

Customer Base

- Our primary customers will likely remain those who provide transportation services. However, there will be a significant expansion in the number and type of those service providers. The States, which played a predominant role in the 1900s, will continue to be major players; however, they too will have a different customer base.
- The greatest growth will be in private-sector service providers. Although toll roads will likely expand, the

greatest growth will come in the form of private providers of specific services, such as traffic and transit information, alternate forms of transit, and routing information.

The customer base will be intermodal. Because service providers will look for optimum ways to move people and goods, they will use a variety of interdependent modes of transportation.

The Federal Government's interaction with other governmental entities will be dictated by the nature of the issues and problems to be solved. Because more of our programs will be driven by safety and operations (versus infrastructure...see below), regional and corridor organizations will become more predominant customers. These organizations also may begin to take a more operational role, versus simply planning.

Programs

- By 2020, State and local governments essentially will operate the transportation infrastructure program independently. User fees may or may not be collected at the State level and forwarded to the Federal level; regardless, there will be little Federal involvement in their use. States will collectively agree upon any national standards for those systems.
- The two major areas where a continued Federal presence is anticipated will be safety and operations. These will not be funding-intensive programs but will instead focus on improving system efficiency. The organization's major role in these programs will be service-assisting with

technical and program issues, introducing and sharing new technology, problem solving, and working hand-in-hand with the transportation community to find solutions.

Organization

- The successor to the FHWA will be a highly decentralized, intermodal organization (although our focus will be surface modes). We will be a smaller organization that will not be organized by modes, but by service areas that cut across the modes.
- To better serve the needs of our diverse customer base, we will be “out there,” both in a physical and virtual sense. The concept of “offices” will have faded and most of our staff will work in the field with our clients and on the road.
- That “road” will likely take the form of an information super highway that provides unconstrained accessibility to all information in the field. Our organization will play a major role in bringing together (but not collecting) the information that will flow on that highway.
- Even as we become a “knowledge-based” organization, personal contact with our customers will remain a vital part of our role. Therefore, most of our staff will be in the field, at times working with (and in) the States, but also in partnerships with our expanded customer base in the private sector.

Staffing

- As our program shifts from an infrastructure-based organization, so will our skill needs. Much greater emphasis will be placed on safety and operational expertise and will draw on a greater range of disciplines (e.g., systems engineers, robotics).
- This change will likely come about through attrition as we relinquish more and more of our infrastructure expertise. However, hiring limitations will bring about increased reliance on contract support in conducting our business (especially in the area of clerical support and service delivery).
- There will be a growing need for expertise in communications and information management, as these skills become increasingly central to the organization’s function.
- Staff will not stay with the agency as long; there will be greater mobility in and out of the private sector, and incentives such as mobile retirement systems will gain wider acceptance. This trend will be further enhanced by a fundamental shift in staff loyalty from the agency to our client base, the direct beneficiary of our efforts.